



2014

ADVANCED MANUFACTURING SURVEY

FROM THE MARYLAND DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

MARYLAND OF OPPORTUNITY.®

www.ChooseMaryland.org



2014 MANUFACTURING SURVEY

2014 MANUFACTURING SURVEY

Manufacturing Classifications

There are 21 separate classifications, or subsectors, for manufacturing activities. In the NAICS coding system, these carry three-digit codes. Maryland contains establishments that are involved in every type of manufacturing.

A list of subsectors can be found below.

Manufacturing employment in Maryland by subsector, 2013 annual average

NAICS SECTOR	ESTABLISHMENTS	RANK	EMPLOYMENT	RANK	AVERAGE YEARLY WAGE	RANK
31-33: Manufacturing Total	3,674		106,451		\$69,211	
311: Food	392	3	14,378	2	\$45,557	17
312: Beverage and tobacco products	77	15	2,840	12	\$49,506	13
313: Textile mills	28	20	529	20	\$47,607	15
314: Textile product mills	111	10	791	18	\$41,077	18
315: Apparel	38	18	1,525	16	\$31,159	21
316: Leather and allied products	11	21	156	21	\$45,654	16
321: Wood products	109	13	2,008	14	\$40,697	19
322: Paper	43	17	2,785	13	\$51,149	12
323: Printing and related support activities	494	1	7,872	5	\$49,245	14
324: Petroleum and coal products	49	16	886	17	\$72,851	4
325: Chemicals	235	6	11,927	3	\$96,934	2
326: Plastics and rubber products	111	10	6,300	8	\$59,977	7
327: Nonmetallic mineral products	178	9	3,819	10	\$51,773	11
331: Primary metal manufacturing	31	19	720	19	\$54,898	8
332: Fabricated metal products	428	2	8,286	4	\$54,644	9
333: Machinery	195	7	6,595	7	\$66,723	5
334: Computer and electronic products	389	4	18,584	1	\$113,597	1
335: Electrical equipment and appliances	80	14	1,762	15	\$61,177	6
336: Transportation equipment	110	12	7,104	6	\$76,018	3
337: Furniture and related products	181	8	3,323	11	\$39,014	20
339: Miscellaneous	384	5	4,261	9	\$54,140	10

Source: DLLR

Manufacturing has consistently been an important contributor to Maryland's economic health. While the manufacturing industry in Maryland is not as large as in other states, it is an important driver of exports, research and development, and employment in multiple industries. Changes in technology, import duties, free trade agreements, and international competition have put the manufacturing industry under pressure in both Maryland and in the United States as a whole. Maryland's manufacturers have responded to these pressures by enhancing product lines, expanding markets, increasing productivity, and operating more efficiently.

Part of the effect of these changes has been an increase in manufacturing output per worker, with a corresponding decrease in manufacturing employment across the nation. Because of the deep and complex effects that the manufacturing sector has on the economy, simply tracking changes in manufacturing employment misses the larger picture. Instead, we have to look at the overall economic impact of the sector.

Maryland, like the rest of the country, has seen significant changes in its manufacturing sector. In the late 1960's, manufacturing workers made up almost 20 percent of the State's total workforce. Today, that statistic is 4 percent. Numerically, manufacturing employment has decreased from 282,000 to 109,000 over the same time period. While employment has decreased, both the State's economy and the manufacturing industry itself has changed radically.

Forty years ago, Maryland's largest manufacturing sector was the "primary metals" industry (establishments that refine and process metals) which employed almost 42,000 workers. Today, that industry is one of the smallest in the State, employing only 700 workers in the third quarter of 2013. Today's largest manufacturing industry in Maryland is Computer and Electronic Products manufacturing, which employs 19,000 workers and did not even exist as a separate sector 40 years ago. Today's manufacturing plant is most likely to include automated computer controlled machinery or high-tech equipment being set up and

operated by highly-skilled workers. Manufacturers are less likely to require large numbers of workers as they did in the past.

Even after the multitude of changes that have occurred in the manufacturing sector, it remains an important contributor to economic prosperity on both the State and National levels. DBED's economic impact analysis of the sector shows that the multiplier effect for the sector within the State is 2.7, meaning that almost two additional jobs are created in the state for each new manufacturing job created. High-technology manufacturers have higher multiplier effects and generate more jobs throughout the economy than their less technologically-oriented counterparts. Maryland's high-tech manufacturing industries have a multiplier effect of 3.1, while the balance of the manufacturing sector has a multiplier effect of 2.3.

MANUFACTURER TYPE	MD	U.S.
Hi-Tech	3.1	6.6
Other	2.3	4.8
Overall	2.7	5.7

Source: DBED analysis using IMPLAN

Nationally, the multiplier effect is larger due to the larger pool of suppliers and customers affected on the national level by the activities of the nation's 10+ million manufacturing workers. Similar to the State's performance, high-tech industries have a larger multiplier effect than other industries.

EMPLOYMENT TYPE	HI-TECH	OTHER	TOTAL
Manufacturing (Direct)	52,099	56,856	108,955
Other	109,175	73,275	182,450
Overall	161,274	130,131	291,405

Source: DBED analysis using IMPLAN

The powerful job-generating effect of the manufacturing sector means that it supports a larger proportion of the State's economy than its job numbers would suggest, with a total of 291,000 being attributable to the sector in Maryland in 2012.

2014 MANUFACTURING SURVEY

Maryland's manufacturing workers are generally paid more than the average worker. Maryland's average private sector pay per worker in 2012 was \$51,910 per year, while the average manufacturing wage was \$68,848. Not all manufacturing industries have this high level of pay, however. While 13 of the State's 21 manufacturing subsectors meet or exceed the State's average worker salary (representing 63% of establishments and 72% of employees), eight do not. Those that pay more are generally made up of advanced manufacturing firms that rely on highly-skilled labor.

To understand what is occurring in Maryland's manufacturing sector, the Department of Business and Economic Development (DBED) worked with the Schaefer Center for Public Policy at the University of Baltimore to field a survey of manufacturing establishments of all types, all across the State, its first since 1994 and the first time that DBED has collected information on advanced manufacturing activities in Maryland.

The Schaefer Center surveyed 4,457 companies involved in manufacturing (every firm employing four or more people), making 16,518 phone calls (an average of 3.7 calls per company). Surveying occurred from the middle of November 2013 to the middle of March 2014. The survey asked about employment and sales growth, workforce needs, advanced manufacturing capabilities, research and development activities, and financing issues. In the end, DBED received data from a statistically-significant 672 firms.

The survey had two major goals: First, to discover the current condition of the manufacturing sector in Maryland, and second, to discover how many firms are involved in advanced manufacturing activities and to obtain general information on those activities.

The survey found that many manufacturing establishments across the State are using advanced methods, equipment, or materials to manufacture their products, and the majority believe their business will grow in the immediate future. However, there are some

firms that are not adopting advanced processes, and some firms feel that their future is uncertain.

“Ultimately, understanding how well manufacturers are performing in their respective markets, what workforce issues they may be facing, and how they are adapting to new technologies and processes will help DBED formulate approaches to further promote the industry.”

What is Advanced Manufacturing?

DBED defines advanced manufacturing using the definition put forth in the *President's Council of Advisors on Science and Technology Report to the President on Ensuring American Leadership in Advanced Manufacturing*:

Advanced Manufacturing is “a family of activities that (a) depend on the use and coordination of information, automation, computation, software, sensing, and networking, and/or (b) make use of cutting edge materials and emerging capabilities enabled by the physical and biological sciences, for example nanotechnology, chemistry, and biology. This involves both new ways to manufacture existing products, and especially the manufacture of new products emerging from new advanced technologies.”

In addition, “Advanced Manufacturing is not limited to emerging technologies; rather, it is composed of efficient, productive, highly integrated, tightly controlled processes across a spectrum of globally competitive U.S. manufacturers and suppliers. For advanced manufacturing to accelerate and thrive in the United States, it will require the active participation of communities, educators, workers, and businesses, as well as Federal, State, and local governments.”

In total, there are five areas that, were a firm implementing one or more of them, would classify it as an advanced manufacturer:

Creating products with advanced manufacturing processes and methodologies. These are products that depend on the latest technologies and research to exist and to be competitive in today's marketplace. Examples are smartphones, additive

2014 MANUFACTURING SURVEY

manufacturing components (3D printing), sensors and biopharmaceuticals. The success (and even the existence) of these products often depends on ongoing research and development programs.

Using advanced manufacturing processes. These processes may be related to the creation of advanced products, or they may not. Advanced processes generally make the manufacturing process more efficient while improving the quality of manufactured goods. This efficiency can result in fewer workers needed to create the same amount of products. Examples of advanced processes are Computer Numeric Control (CNC) machines, robotic product assembly, and 3D printing. Advanced production processes also allow manufacturers to efficiently and quickly design, engineer and manufacture products to order and to have highly-scalable production processes that allow them to vary the quantity of products manufactured while maintaining or improving quality or production schedules.

Using advanced materials. Companies who are using advanced materials to create their products are also considered to be advanced manufacturers. While the use of advanced materials does not necessarily mean that a firm is employing advanced processes or creating advanced products, these often go hand-in-hand. Examples of advanced materials are carbon-fiber composites and nano materials.

Implementing advanced supply chain management techniques. Creating an advanced manufacturing firm often requires creating an advanced supply chain management system. In the past, firms would often order or create large amounts of components and materials and store them until they were needed. This would inhibit manufacturing flexibility and limit these firm's production capabilities to use of these components, which adversely affects the ability of a firm to respond and adjust to market conditions or implement incremental product improvements that could improve competitiveness. Advanced supply chain techniques avoid these problems by reducing a firm's

inventory investment and coupling firms more closely with their component and transport suppliers, allowing firms to be more flexible and to respond quickly to market changes. Advanced supply chain techniques reduce supply chain risk for the manufacturer and often contracts the supply chain giving preference to suppliers in closer proximity to the point of consumption. Manufacturers with material content exceeding 50% of total product cost should pay close attention to supply chain risk including primary and secondary supplier locations.

Using sustainable practices. While not directly connected to advanced manufacturing, sustainable practices cut pollution and waste, allow firms to integrate better into their surroundings, and ultimately save firms money by making them more efficient. Sustainable practices also include energy conservation practices. Energy consumption is one of the largest cost drivers for manufacturers. New and emerging technologies increase energy efficiency and reduce energy consumption increasing competitiveness.

Survey Results

DBED's manufacturing survey asked questions of firms in eight different areas:

- Advanced Manufacturing
- Business Demographics
- Sales
- Exports
- Supply Chain
- Workforce
- R&D Investment
- Financing

Some of the most interesting and relevant findings from this year's survey follow.

2014 MANUFACTURING SURVEY

Advanced Manufacturing

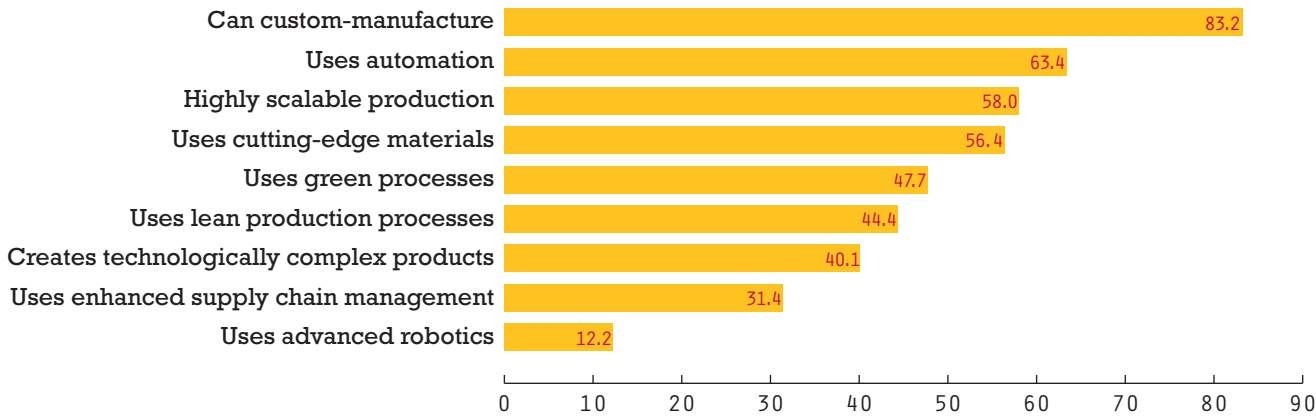
Manufacturers reporting Advanced Manufacturing activities in Maryland, 2014

IS FIRM ADVANCED?	ESTABLISHMENTS	PERCENTAGE	EMPLOYMENT	PERCENTAGE
Yes	369	54.9%	11,307	61.6%
No	292	43.5%	6,884	37.5%
Don't know	11	1.6%	171	0.9%
Total	672	100.0%	18,362	100.0%

DBED's survey of manufacturers found that 55 percent identified themselves as advanced manufacturers, and that these firms employed 62 percent of all workers.

Almost two-thirds of Maryland manufacturers consider themselves to be "green" or "clean" manufacturers.

Reasons why a firm is an Advanced Manufacturer

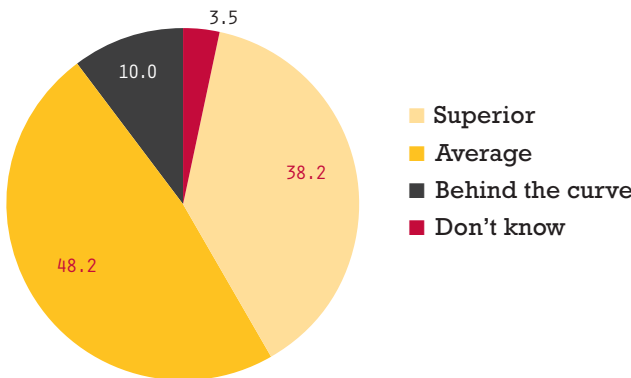


The majority of advanced manufacturing firms consider themselves as such because they have the ability to custom-manufacture products to customer requirements and use automation in their production processes. Due to Maryland manufacturers' focus on producing leading-edge, customized products in low

production volumes, the use of advanced robotics in the manufacturing process has not been widely adopted here. Robotics are more likely to be found in manufacturers that produce large numbers of similar products.

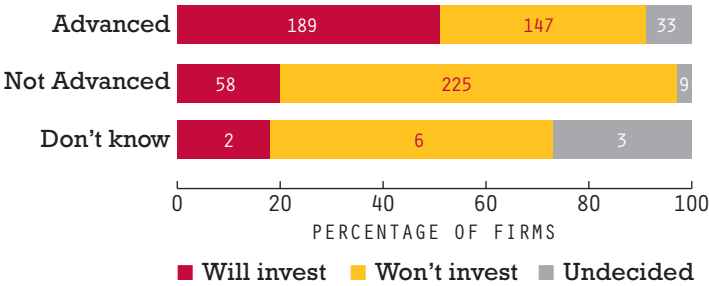
Adoption level of Advanced Manufacturing

The vast majority of advanced manufacturing firms in Maryland felt that their adoption level of advanced manufacturing techniques was either superior to their competitors or in line with their competition.



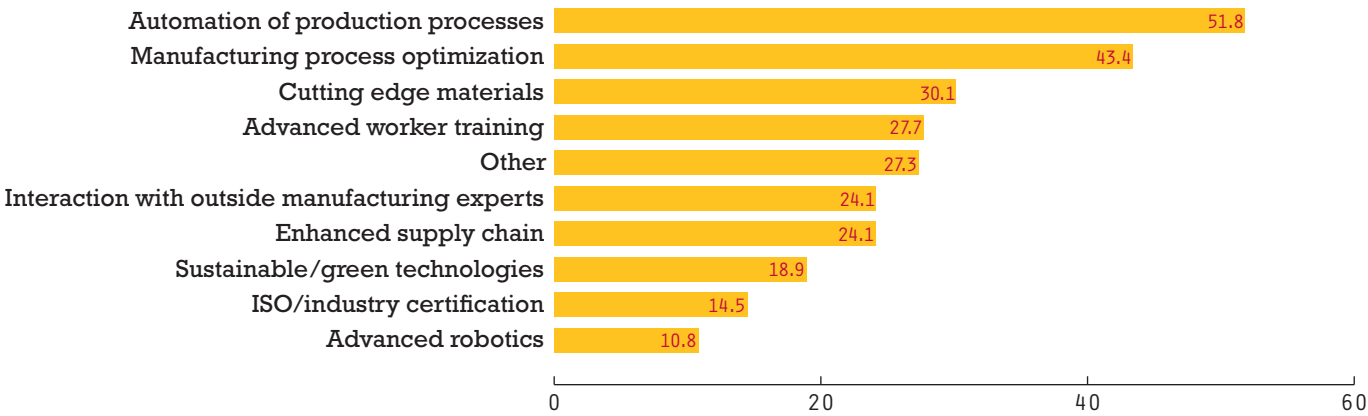
2014 MANUFACTURING SURVEY

Plans to invest in Advanced Manufacturing



More than half of all advanced manufacturing firms were planning on making continued investments in advanced manufacturing processes within the next 12 months, while one-fifth of traditional firms were planning on making new investments in this area.

Planned areas of Advanced Manufacturing investment



The most likely area of investment was in the automation of production processes, followed closely with the related goal of optimizing manufacturing processes. A significant proportion of firms were interested in investing in the use of cutting-edge

materials to create their products, improving worker skills, and bringing in outside consultants to advise them on their investments. The highly specialized area of robotics was the least common area of investment.

Business Demographics

Most Maryland manufacturers were found to be small, locally-owned businesses. Seventy percent of manufacturing firms in Maryland reported being family-owned, and 81 percent reported operating out of one location. Family-owned firms were much more likely to be sole proprietorships than other firm types.

The vast majority of manufacturing establishments (75%) employ fewer than 20 workers. However, these employ only 12 percent of all manufacturing workers.

About half (48%) of all manufacturing firms are involved in creating finished goods for sale to customers. Seventeen percent are involved in creating products engineered to order, and 12 percent process raw materials.

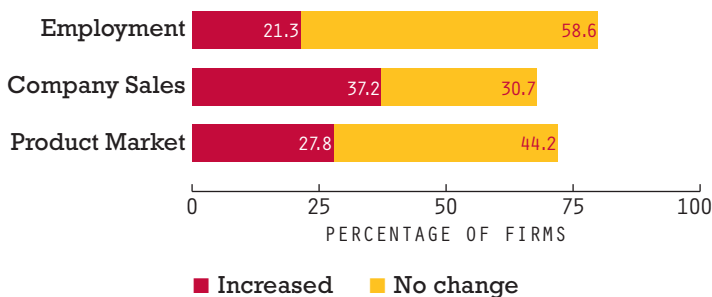
The survey found that smaller firms were less likely to have invested in advanced manufacturing technologies or techniques. Family-owned firms were somewhat less likely to have made these investments than other firm ownership types, though the majority of family-owned firms report that they are advanced manufacturers (52% vs. 62%).

2014 MANUFACTURING SURVEY

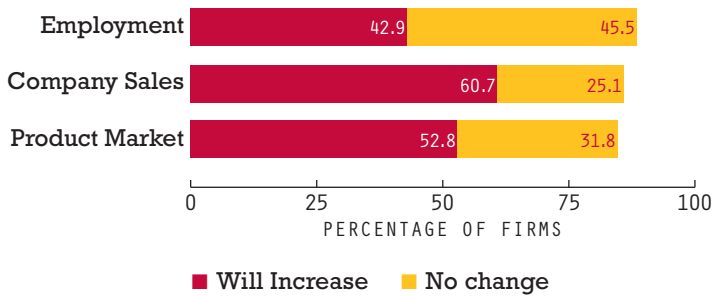
Sales

Most of the firms that were surveyed reported that their markets and sales either remained stable or grew over the last year. Interestingly, 37 percent of firms saw their own company's sales increase over the last 12 months, but only 28 percent saw the overall market for their product increase, which implies that many of Maryland's firms are having success at penetrating existing markets and growing their market share. Note that these firms are growing sales without growing employment, as almost 60 percent reported that their employment has neither increased nor decreased over the past 12 months.

Sales, employment and market changes last 12 months



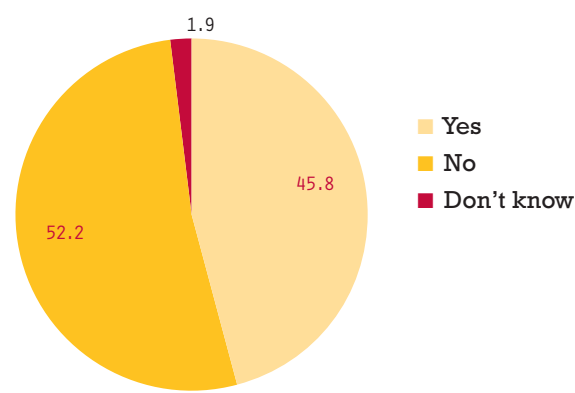
Expected change, next 12 months



Maryland's firms are positive about future growth, with 61 percent forecasting growing sales over the next year. Even so, only 43 percent are forecasting a need for new employees over that time period indicating that, on average, Maryland manufacturers have high levels of productivity, which allows them to increase sales without increasing employment.

One-fifth of surveyed manufacturers had plans to expand over the next 12 months, and 81 percent of those planned to expand in Maryland.

Does your firm sell the majority of its products outside Maryland?



Almost half (46%) report that they sell the majority of their products to customers outside of Maryland. For advanced manufacturers, the rate is 54 percent.

Exports

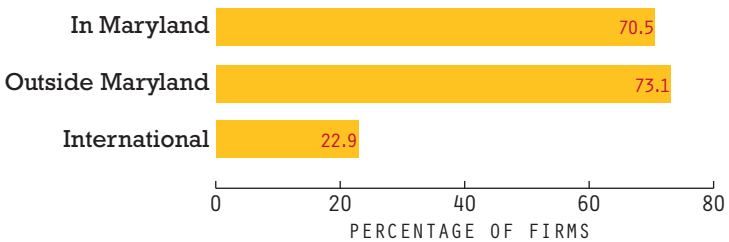
The value of Maryland's manufactured exports has grown over 29 percent since 2009. Even with this growth, only 31 percent of Maryland's manufacturers are exporters. Companies that report themselves to be advanced manufacturers are almost twice as likely to be exporters than those that do not (39% vs 21%).

The top three most common reasons for not exporting were that firms felt that their products were only intended for local markets (56% of all non-exporters), they lacked resources, knowledge, or internal expertise (12.7% of all non-exporters), or that U.S. markets absorbed all of their output, leaving no need to find foreign markets (12% of all non-exporters).

2014 MANUFACTURING SURVEY

Supply Chain

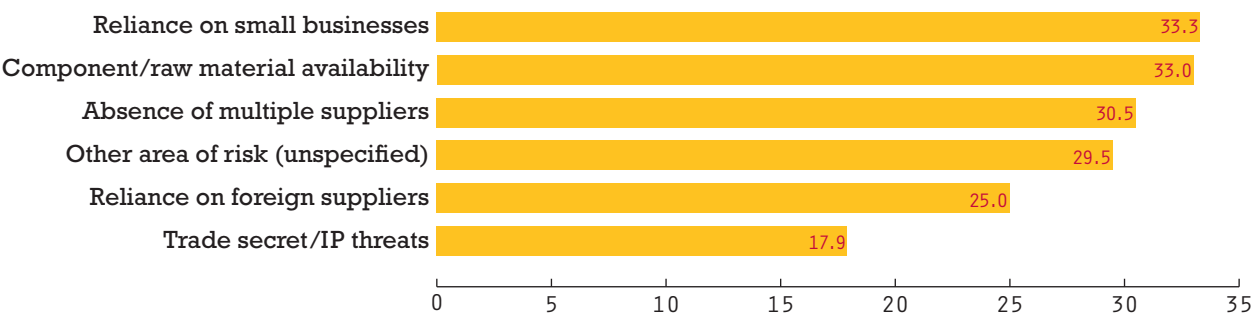
Supply chain involvement



The majority of Maryland manufacturers are involved in the supply chain of other firms (either as a customer or a supplier) that are based locally or within other U.S. states. However, only 23 percent reported being involved in international supply chains.

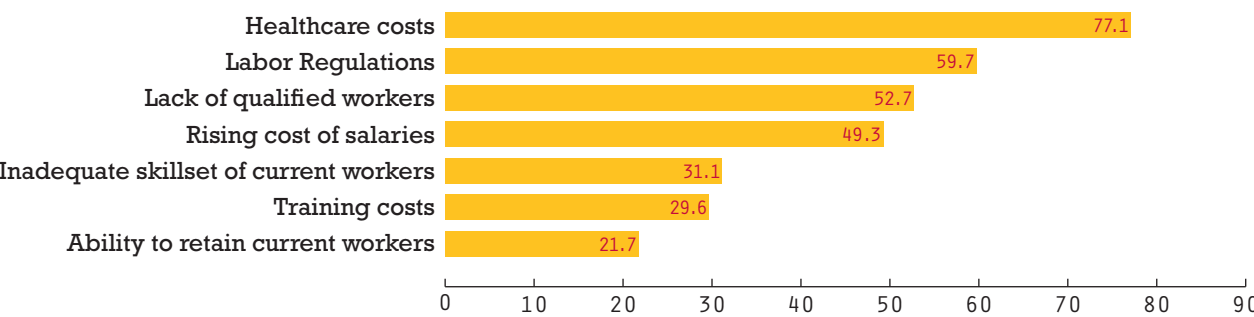
Manufacturers saw some areas of supply chain risk that had the potential to negatively affect their businesses. Highest on the list was reliance on small businesses for components or sales, with problems with the availability of components or raw materials coming in at a close second. Lowest on the list were threats to a firm's trade secrets or intellectual property, although 18 percent of firms felt that this was an area of concern.

Areas of supply chain risk



Workforce

Workforce issues of concern



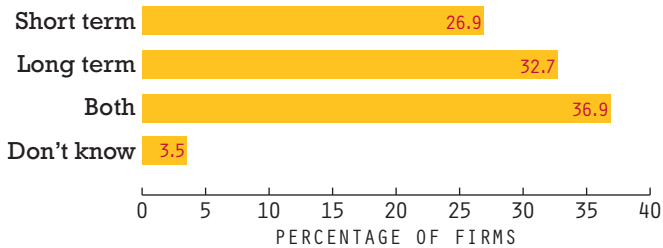
More than half of Maryland's manufacturers report that there is a lack of qualified workers to fill vacant positions in their industry.

Fully 77 percent of manufacturers feel that healthcare costs are a problem for their firms, and almost 60 percent feel that labor regulations are an issue that is affecting their businesses.

2014 MANUFACTURING SURVEY

Workforce (continued)

Length of labor shortage



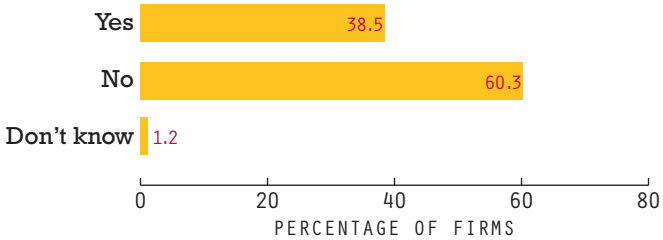
Almost 40 percent of survey respondents reported having problems recruiting workers over the past year (not surprising considering most firms did not hire new employees). Of firms that did hire, 90 percent reported problems with finding skilled workers.

More than two-thirds of firms with labor shortages reported that their shortages were long term problems.

To help combat skills shortages, and to keep existing workers current, the majority of Maryland manufacturers surveyed (74%) reported having internal training programs for their workers.

R&D Investment

Does firm invest in R&D?



More than one-third reported investing in R&D, and almost all of those firms operated their own internal R&D programs.

Sixty percent of firms reported R&D activities in collaboration with their business partners. A small percentage reported technology transfer and licensing

agreements with University or Federal laboratories and research institutions, a surprising outcome due to the volume and breadth of research being performed in Maryland by Universities and Federal laboratories.

Only 17 percent of Maryland manufacturing firms hold their own patents. Of those, a third have applied for patents within the last 12 months. While patents serve to protect a firm's intellectual property, patent applications often demand disclosure of trade secrets. Many companies (especially advanced manufacturers) instead rely on speed to market and industry-leading technological innovation to maintain their market position.

Fifty percent of the State's Research and Development tax credit funding in FY2013 went to manufacturing firms, which make up a third of all firms receiving those credits.

Financing

Slightly under one-third of manufacturing firms sought financing from banks or other financial institutions over the last year. Of these, 59 percent reported that the experience was somewhat difficult (20%) or very difficult (29%). Since advanced manufacturing companies must constantly reinvest in technology in order to remain competitive, difficulties

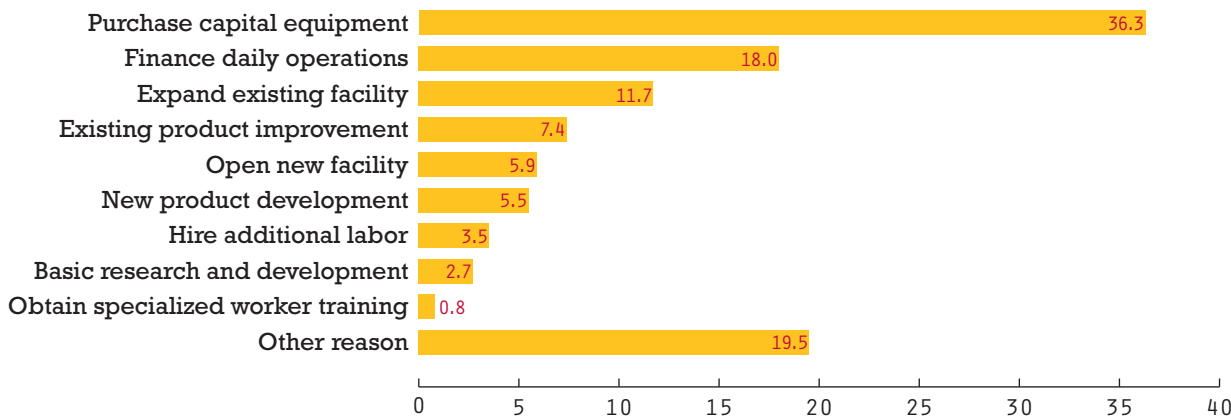
with obtaining capital can be a barrier for success for manufacturers in Maryland.

The most common reason for seeking funding was to purchase capital equipment (36 percent of respondents). The second-most common reason was to finance daily operations (18 percent), followed by expansion of existing facilities (12 percent).

2014 MANUFACTURING SURVEY

Financing (continued)

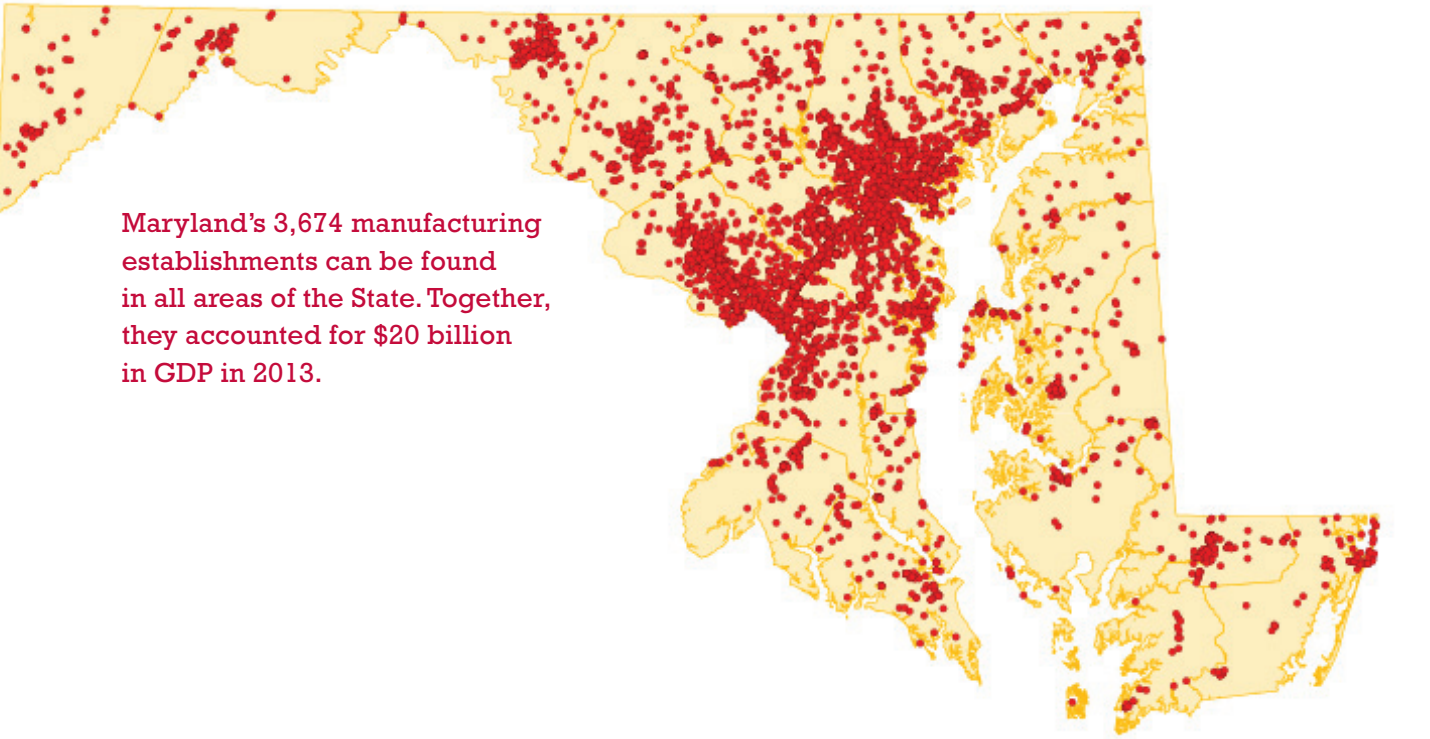
Reasons for obtaining financing



Slightly more than half of all respondents reported being aware of tax credits or other financial assistance that may be available to Maryland companies. Larger firms were more likely to be aware of incentive programs than smaller firms.

Of firms that were aware of funding programs, 64 percent reported that their firm had not benefitted from them, with 15 percent reporting benefits from tax incentive programs.

Manufacturing in Maryland



MARYLAND OF OPPORTUNITY.®

www.ChooseMaryland.org

For more information about Advanced Manufacturing in Maryland, contact:

Carl Livesay, Manufacturing Director • carl.livesay@maryland.gov • 410-456-4260

Joyce La Padula, Manufacturing Program Manager • joyce.lapadula@maryland.gov • 410-960-3785

Maryland Department of Business & Economic Development